



Citation for published version:
Narduzzo, A & Parmar, NR 2011, 'Chalk, Talk, Digital Pens and Audience Response Systems - Combining tradition and technology to improve maths learning.', Innovations Day, University of Bath, 12/05/11.

Publication date:
2011

[Link to publication](#)

University of Bath

Alternative formats

If you require this document in an alternative format, please contact:
openaccess@bath.ac.uk

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Chalk, Talk, Digital Pens and Audience Response Systems

Combining tradition and technology to improve maths learning

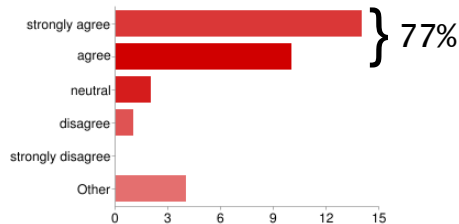
Alessandro Narduzzo, Department of Physics, University of Bath, A.Narduzzo@bath.ac.uk
Nitin Parmar, Learning & Teaching Enhancement Office, University of Bath, N.R.Parmar@bath.ac.uk

I. Aim

To enhance maths learning by facilitating student interaction and peer instruction in problem classes using Turning Point™ audience response systems – “clickers” – and PaperShow™ digital – “optical” – pen(#).

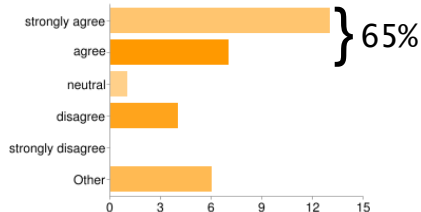


«I think the optical pen is a useful tool for interactive learning and its use improved my learning experience.»



VII. Student feedback

Questionnaire(b) results (31 responses from approx. 40 students attending problem classes)



II. Interactive problem classes: combined Mazur/Dufresne sequences involving peer instruction

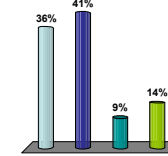
- (1) Set question + 5 min.s of individual work
- (2) Click answer
- (3) Discuss answer with other students
- (4) Re-click answer
- (5) Paper-show and chalk and talk right answer

III. Click (2) answer,

The ratio test shows that the series

$$\sum_{n=1}^{\infty} \left(\frac{4}{5}\right)^n n^5$$

1. Is convergent;
2. Is divergent;
3. Can't be established;
4. Do not know.

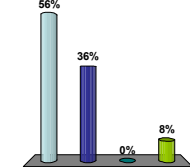


IV. re-click (4) answer,

The ratio test shows that the series

$$\sum_{n=1}^{\infty} \left(\frac{4}{5}\right)^n n^5$$

1. Is convergent;
2. Is divergent;
3. Can't be established;
4. Do not know.



right answer

V. paper-show (5) and...

$$\lim_{n \rightarrow \infty} \frac{u_{n+1}}{u_n} = \lim_{n \rightarrow \infty} \frac{\left(\frac{4}{5}\right)^{n+1} (n+1)^5}{\left(\frac{4}{5}\right)^n n^5} = \frac{4}{5} \lim_{n \rightarrow \infty} \frac{(n+1)^5}{n^5} = \frac{4}{5} \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^5 = \frac{4}{5} (1)^5 = \frac{4}{5} < 1$$

∴ series convergent by ratio test.

VI. ...Chalk and talk (5) correct answer.



(Я)

$$\lim_{n \rightarrow \infty} \frac{u_{n+1}}{u_n} = \frac{4}{5} < 1 \Rightarrow \text{series convergent by ratio test.}$$

$$u_n = \left(\frac{4}{5}\right)^n n^5$$

$$u_{n+1} = \left(\frac{4}{5}\right)^{n+1} (n+1)^5$$

$$\frac{u_{n+1}}{u_n} = \frac{\left(\frac{4}{5}\right)^{n+1} (n+1)^5}{\left(\frac{4}{5}\right)^n n^5} = \frac{4}{5} \left(\frac{n+1}{n}\right)^5 = \frac{4}{5} \left(1 + \frac{1}{n}\right)^5$$

$$\lim_{n \rightarrow \infty} \frac{4}{5} \left(1 + \frac{1}{n}\right)^5 = \frac{4}{5} (1)^5 = \frac{4}{5} < 1$$

∴ convergent!

(#) More information on these and other Classroom Technologies can be found at the blog <http://go.bath.ac.uk/ct;>

(Я) Image captured using Panopto™;

(b) Questionnaire designed, delivered and analysed via Google™ Forms;

(*) Word cloud produced via www.wordle.net: the word size within the cloud is proportional to its frequency within the processed text.